

# TL1591 SAMPLE-AND-HOLD CIRCUIT FOR CCD IMAGERS

D3327, SEPTEMBER 1989

- 15-MHz Sampling Rate
- 30-ns Acquisition Time
- Diode-Bridge Switch
- 25-MHz Bandwidth
- Low-Voltage Supply

D OR P PACKAGE  
(TOP VIEW)

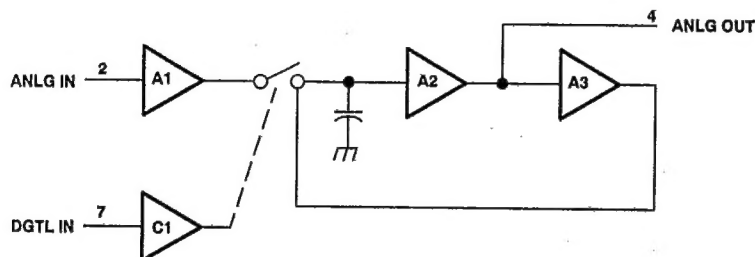
T-77-17

ANLG V <sub>CC</sub>	1	8	DGTL V <sub>CC</sub>
ANLG IN	2	7	DGTL IN
ANLG GND	3	6	DGTL GND
ANLG OUT	4	5	SUB GND

## description

The TL1591 is a monolithic integrated sample-and-hold circuit with excellent performance features using the BIFET process with Schottky-barrier diodes and designed for use with CCD area imagers. This device consists of an ultra-fast input buffer amplifier, a digital-controlled diode-bridge switch, and a high-impedance output buffer amplifier. The electronic switch is controlled by an LS-TTL-compatible logic input.

## functional block diagram



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CCD Image Sensors/Support Functions

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## TL1591

## SAMPLE-AND-HOLD CIRCUIT FOR CCD IMAGERS

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absolute maximum ratings over operating free-air temperature range (unless otherwise noted)

Supply voltage, $V_{CC}$	7 V
Digital input voltage	0 to $V_{CC}$
Continuous total dissipation	See Dissipation Rating Table
Operating free-air temperature range, $T_A$	-25°C to 80°C
Storage temperature range	-55°C to 150°C

DISSIPATION RATING TABLE

PACKAGE	$T_A \leq 25^\circ\text{C}$ POWER RATING	DERATING FACTOR ABOVE $T_A = 25^\circ\text{C}$	$T_A = 80^\circ\text{C}$ POWER RATING
D	725 mW	5.8 mW/°C	406 mW
P	1000 mW	8.0 mW/°C	560 mW

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## recommended operating conditions

	MIN	NOM	MAX	UNIT
$V_{CC}$ Supply voltage	4.75	5	5.5	V
$V_{IH}$ High-level digital input voltage	2			V
$V_{IL}$ Low-level digital input voltage			0.8	V
$V_{I-PP}$ Peak-to-peak analog input voltage			0.8	V

## electrical characteristics over operating free-air temperature range (unless otherwise noted)

PARAMETER	TEST CONDITIONS	MIN	TYP†	MAX	UNIT
$V_{IK}$ Input clamp voltage				-1.5	V
$V_{O,PP}$ Analog peak-to-peak output voltage			1.1		V
$I_{IH}$ High-level input current	$V_{CC} = 5.5\text{ V}$ , $V_{IH} = 2.7\text{ V}$			20	$\mu\text{A}$
$I_{IL}$ Low-level input current	$V_{CC} = 5.5\text{ V}$ , $V_{IL} = 0.4\text{ V}$	-0.28		-0.4	mA
$I_O$ Analog output current			0.6		mA
$I_{CC}$ Supply current	$V_{CC} = 5.5\text{ V}$		15	20	mA
$r_i$ Input resistance			10		k $\Omega$
$r_o$ Analog output resistance			50		$\Omega$

## operating characteristics

PARAMETER	MIN	TYP†	MAX	UNIT
Linearity		0.7%	2%	
$A_v$ Voltage amplification		0.8	0.9	V/V
Sample-to-hold offset error		15		mV
Sample-mode offset error		-50	50	mV
Hold-mode feedthrough			-50	dB
Hold-mode droop			100	$\mu\text{V}/\mu\text{s}$

† All typical values are at  $V_{CC} = 5\text{ V}$ ,  $T_A = 25^\circ\text{C}$ .

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dynamic characteristics (see Figure 1)

PARAMETER	MIN	TYP†	MAX	UNIT
Acquisition time 0.6 V to 2% (see Note 1)		18		ns
Acquisition time 0.6 V to 1% (see Note 1)		31		ns
Hold-mode settling time (see Note 2)		35		ns
Sampling-mode bandwidth		25		MHz
Sampling rate			15	MHz

† All typical values are at V<sub>CC</sub> = 5 V and T<sub>A</sub> = 25°C.

PARAMETER MEASUREMENT INFORMATION

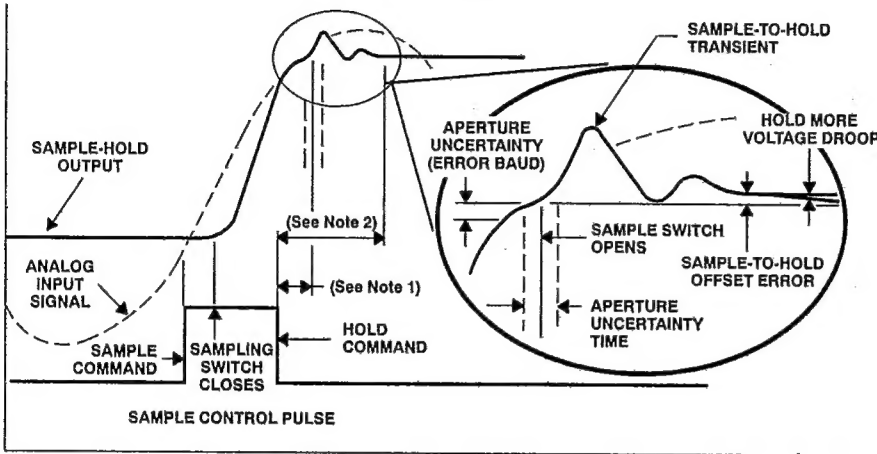


FIGURE 1. SAMPLE-HOLD DEFINITIONS

- NOTES: 1. Acquisition time is the time required, after the closing of the sampling switch, for the hold capacitor to charge to a full-scale voltage change and then remain within a specified error band around the final value.
2. Hold-mode settling time is the time from the hold command transition until the output has settled within a specified error band around the final value.

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CCD Image Sensors/Support Functions

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## PARAMETER MEASUREMENT INFORMATION

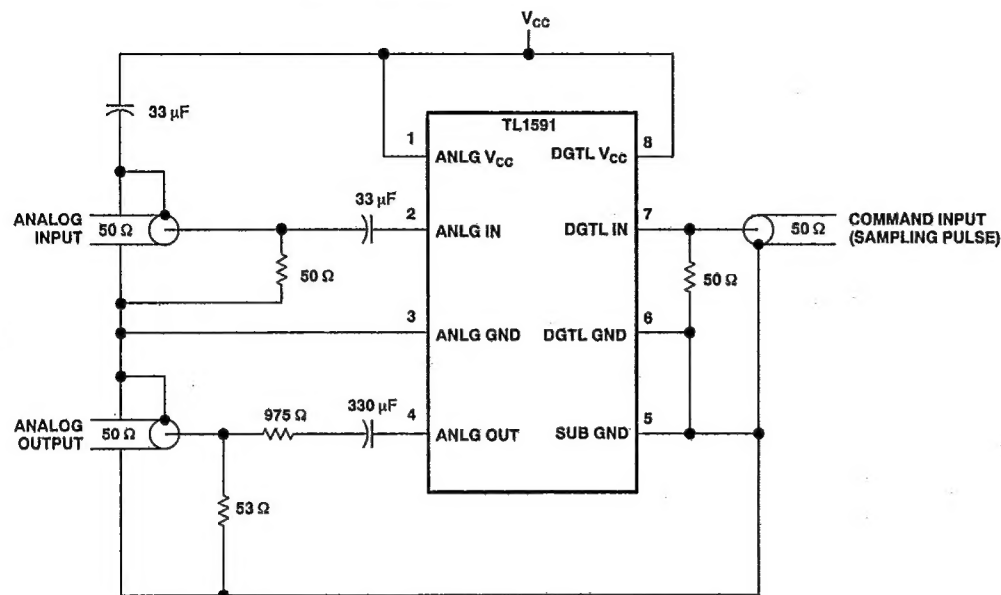


FIGURE 2. TEST CIRCUIT

## TYPICAL CHARACTERISTICS

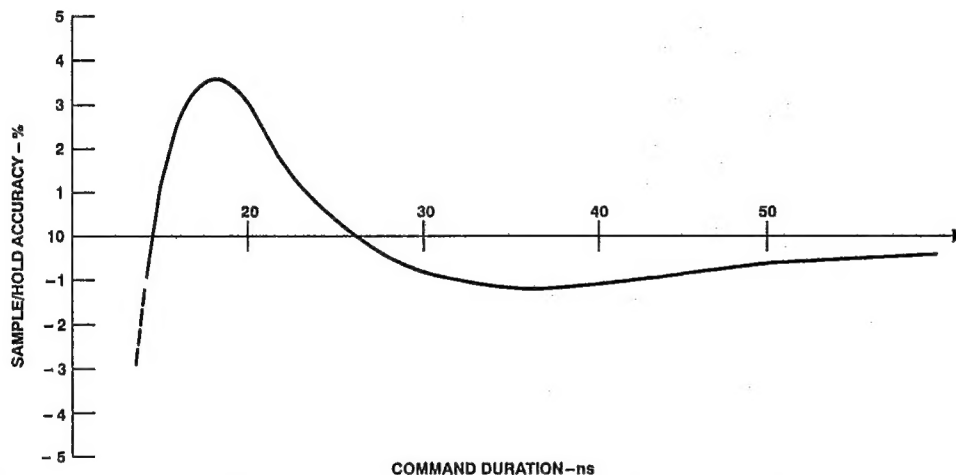


FIGURE 3. SAMPLE/HOLD ACCURACY VS COMMAND DURATION